

MISSION OPERATIONS DATA ANALYSIS TOOLS FOR MARS OBSERVER GUIDANCE AND CONTROL*

Edwin P. Kan

Jet Propulsion Laboratory
California Institute of Technology
4800" Oak Grove Drive
Pasadena, Ca 91109

(818) 393-0928

FAX: (818) 393-7830

email: ekan@jplpost.jpl.nasa.gov

ABSTRACT

Mission operations for the Mars Observer (MO) Project at the Jet Propulsion Laboratory (JPL) were supported by a variety of ground data processing software and analysis tools, some of which were generic to multimission spacecraft mission operations, some of which were applicable to all the subsystems of the MO spacecraft, and some of which were MO subsystem specific. The subsystem under discussion is the Attitude and Articulation Control Subsystem (AA(X).

The JPL Advanced Multi-Mission Operations System (AMMOS) formed the backbone of the ground data system. The MO AMMOS hardware and software system provided the integrated telemetry data retrieval, front-end processing, and archiving functions. While not attempting to redescribe the AMMOS capability which has been described elsewhere, this paper will highlight the customization of the AMMOS real-time on-line telemetry analysis tools for MO AA(X mission operations. The sets of displays of data lists and time plots customized and optimized using human engineering guidelines, designed and used throughout the 11-month cruise phase of MO will be exhibited. Additionally, the AACs telemetry dictionary will be discussed, as it related to the development of the data lists and plots.

The second class of analysis tools used in MO AA(X mission operations was categorized as non-real-time analysis tools. This referred to the non-real-time monitoring processes and analysis tools apart from the above first category of real-time on-line tools. This class consisted, in part, of AMMOS data retrieval, tabulation, plotting, and statistics summary software programs and UNIX shell scripts. These tools also included geometric graphic tools, the "MOBALL", for visualizing the spacecraft in the celestial sphere. Custom data analysis tools for deriving information from the telemetry measurements, such as differencing, comparing, coordinate transformation functions, will also be discussed.

The third class of analysis tools was categorized as non-real-time analysis and performance evaluation tools, not necessarily nor directly dealing with telemetry (downlinked) data. They included ephemeris generation, star catalog generation, maneuver pointing optimization, spacecraft mass change estimates, momentum unloading prediction software etc. Additionally, there was a custom developed spacecraft controls and dynamics simulation software package, 1 database

spreadsheets were also customized for maneuver updates and miscellaneous data computation and verification.

The fourth and last class of analysis tools was used to perform near-real-time data generation, extraction, packaging, and viewing functions.

MO AA(X) mission operations were greatly streamlined with the help of these analysis tools. These tools, some generic to spacecraft mission operations and some specifically tailored to Mars Observer, will be discussed in this paper.

- * This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology, under contract to the National Aeronautics and Space Administration.